



The first case of conjoined twin harbour porpoises *Phocoena phocoena* (Mammalia, Cetacea)

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ABSTRACT

The harbour porpoise (*Phocoena phocoena*) is the smallest and most abundant cetacean in NW European continental shelf waters. Their global abundance numbers at least ~700,000 individuals. Within the North Sea, total abundance has recently been estimated at approximately 345,000 animals. The species reproduces at a rate of one offspring every 1-2 years. In this article we describe a case of conjoined twins in the harbour porpoise: a *parapagus dicephalus* bycaught in the Southern North Sea in May 2017. Reports of conjoined twins in wild mammals are extremely scarce. This case concerns the second known case of twinning and the first case of conjoined twins in *P. phocoena*, the fourth known case of *parapagus dicephalus* in any cetacean species and the tenth known case of conjoined twinning in a cetacean species.

Keywords *Phocoena phocoena*, harbour porpoise, conjoined twins, *parapagus dicephalus*, dysmorphology, North Sea

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INTRODUCTION

The harbour porpoise (*Phocoena phocoena*) is the smallest and most abundant cetacean in NW European continental shelf waters (Camphuysen & Smeenk 2016). Their global abundance is at least ~700,000 individuals. Within the North Sea, total abundance was estimated at 345,000 (CV = 0.18) animals. Numbers in the North Sea at large appear to be stable. No changes in abundance have been noted since 1994 (Ham-

mond *et al.* 2017). From 1900 to the early 1950s, harbour porpoises were abundant and widespread throughout the North Sea, including Dutch waters, but virtually none were reported (dead or alive) in the Southern Bight from the 1960s through 1980s, when the species was considered almost locally extinct. A marked change in distribution occurred in the late 1990s and early 2000s, when large numbers of porpoises moved into the Southern North Sea, possibly as a result of food shortages fur-

ther north (Camphuysen 2004; Hammond *et al.* 2013, 2017). The harbour porpoise is now a common resident in Dutch waters, year round, but with the highest densities in spring, and reproduces at a rate of one offspring every 1-2 years (Camphuysen & Smeenk 2016; Gilles *et al.* 2016).

Conjoined twins ('Siamese twins') are rare, but well known in man, domestic and laboratory mammals, domestic and wild birds and in wild and captive-bred reptiles, amphibians and fishes, but are very rarely described in wild mammals (Kompanje 2005a; Kompanje & Hermans 2008). The precise incidence is unknown, most likely due to high prenatal and antenatal mortality. Almost all published cases of symmetrical conjoined twins in wild mammals concern embryos and fetuses found during the dissection of dead pregnant females (Kompanje 2005a; Kompanje & Hermans 2008). Descriptions of conjoined twins in whales and dolphins (*Cetacea*) are extremely rare. We were aware of only nine published cases (Table 1).

Here we describe an additional case of newborn symmetrical conjoined twin harbour porpoises that apparently went through parturition, but quickly died thereafter.

CASE REPORT

On May 30, 2017 dead neonate harbour porpoise conjoined twins were by-caught in a beamtrawl net, in the North Sea, about 15 nautical miles (28 km) west of Hoek van Holland, the Netherlands, at 52° North, 3° 45' East.

It clearly concerns a neonate. The dorsal fin is not erected, pliable and lacks firmness, the umbilicus is still open and hairs are visible on both upper rostrums (Fig. 1). The length was estimated by the fishermen to be 70 cm and estimated weight at least 6 kg. Two complete and well-developed heads and one well-developed postcranial body with two pectoral fins makes the diagnosis of symmetrical *parapagus dicephalus* conjoined twins accurate (Fig. 1 B). The genital slit indicates male sex (Fig. 1 C). Both pectoral fins are well-developed (Figs. 1 A, D).

Specimen lost

The crew of the fishing vessel thought it would be illegal to keep the dead porpoise and they threw the specimen back into the sea. Fortunately, first a series of photographs was taken.

The specimen, however, is lost for science and natural history.

DISCUSSION

Even normal twinning is extremely rare in cetaceans. González *et al.* (1999) estimated a 0.5% incidence of multiple gestation of all observed pregnant females in small cetaceans. Davison *et al.* (2016) give an overview of all published cases of normal and conjoined twinning in sixteen different species of whales, dolphins and porpoises. In harbour porpoises, adult females produce on average one offspring every 1-2 years (Olafsdóttir *et al.* 2003, IJsseldijk *et al.* 2014). IJsseldijk *et al.* (2014) reported the first, and until now only, known case of normal twinning in the harbour porpoise.

Including the present case in *Phocoena phocoena*, only ten cases of symmetrical conjoined twins in cetacean species have been described in the literature (Kawamura 1969; Kawamura & Kashita 1971; Zemsky & Budylenko 1973; Kamiya *et al.* 1981; Zinchenko & Ivashin 1987; Kompanje 2001, 2005b; Dabin *et al.* 2004; Aytemiz *et al.* 2014; Tamburin *et al.* 2014), including four species of Mysticeti (*Balaenoptera borealis*; *B. acutorostrata*; *Megaptera novaeangliae* and *Eschrichtius robustus*) and three species of Odontoceti (*Stenella coeruleoalba* [2 cases]; *Tursiops truncatus* [3 cases] and *Phocoena phocoena*); see Table 1.

Conjoined twins can be separated in symmetrical and asymmetrical twins. Symmetrical conjoined twins concern two equal conjoined parts (the classic 'Siamese twins'). External parasitic conjoined twins are unequal, asymmetrical conjoined twins in which one (the autosite) is nearly or completely normal, while the other (the parasite) is incomplete, and attached to and dependent on the autosite (Kompanje 2005a). Symmetrical conjoined twins are most probably the result of secondary fusion of two originally separate monovular embryonic discs in which stem cells find identical stem cells on the other twin resulting in fusion, or might result from incomplete fission producing a partially split zygote (Spencer 2003). The etiology of conjoined twins remains enigmatic. Conjoined twins, like normal identical twins, always share one amniotic sack and chorion. Some share one umbilical cord, other types, like the *thoracopagus*, have two umbilical cords.

Table 1 Published cases of conjoined twins in *Cetacea*.

reference	species	taxonomy	age
Kawamura 1969	<i>Balaenoptera borealis</i>	<i>thoracopagus</i>	fetuses
Zemsky & Budylenko 1970	<i>Megaptera novaeangliae</i>	<i>omphalopagus</i>	fetuses
Kawamura & Kashita 1971	<i>Stenella coeruleoalba</i>	<i>cephalopagus</i>	fetuses
Kamiya <i>et al.</i> 1981	<i>Stenella coeruleoalba</i>	<i>parapagus dicephalus</i>	fetuses
Zinchenko & Ivashin 1987	<i>Balaenoptera acutorostrata</i>	<i>thoracopagus</i>	fetuses
Kompanje 2001 & 2005b	<i>Tursiops truncatus</i>	<i>parapagus dicephalus</i>	neonates
Dabin <i>et al.</i> 2004	<i>Tursiops truncatus</i>	<i>parapagus diprosopus</i>	neonates
Aytemiz <i>et al.</i> 2014	<i>Tursiops truncatus</i>	<i>parapagus dicephalus</i>	neonates
Tamburin <i>et al.</i> 2014	<i>Eschrichtius robustus</i>	<i>thoracopagus</i>	neonates
this contribution	<i>Phocoena phocoena</i>	<i>parapagus dicephalus</i>	neonates



Figure 1 Harbour porpoises (*Phocoena phocoena*), newborn males, *parapagus dicephalus*. Southern North Sea, the Netherlands, 30 May 2017.

A both heads in frontal view: hairs are clearly visible on both upper rostra. **B** dorsal view: the dorsal fin is not erected, pliable and lacks firmness.

C ventral view: the umbilicus is still open; male genital slit clearly visible. **D** dorso-lateral view. (Henk Tanis)

Taxonomy of conjoined twins

Conjoined twins are always conjoined in one of eight sites (Spencer 2003) and are named after the site of union:

- 1 *thoracopagus* - united ventrally at the chest; in most cases the twins share one heart.
- 2 *omphalopagus* - united ventrally at the abdomen; the hearts are never involved, but the liver and digestive system is shared in most cases.

A complex form of *thoracopagus* and *omphalopagus* is the *thoraco-omphalopagus* in which the two bodies are fused from the upper chest to the lower chest.

- 3 *cephalo(thoraco)pagus* - united ventrally at head and chest, resulting in severe non-viable malformations of the fused brains.
- 4 *(omphalo)ischiopagus* - united ventrally at the pelvis.
- 5 *parapagus* - united laterally, fused side-by-side sharing one pelvis, fused at the abdomen and (parts of) the thorax; two types occur: *parapagus dicephalus* - one body, two heads and *parapagus diprosopus* - one body, two faces.
- 6 *craniopagus* - united at the heads.
- 7 *pygopagus* - united caudally.
- 8 *rachipagus* - united dorsally at the spine.

In the known cetacean conjoined twins, three could be identified as *thoracopagus*, one as *omphalopagus*, one as *cephalopagus*, four as *parapagus dicephalus* and one as *parapagus diprosopus* (Table 1).

The symmetrical conjoined twin harbour porpoises described here can be determined as *parapagus dicephalus*. Three other cases of *parapagus dicephalus* are known in cetacean species, one in *Stenella coeruleoalba* (Kamiya et al. 1981) and two in *Tursiops truncatus* (Kompanje 2001, 2005b; Aytemiz et al. 2014).

CONCLUSION

This case concerns the second known case of twinning, the first case of conjoined twins in *Phocoena phocoena*, the fourth known case of *parapagus dicephalus* in a cetacean species and the tenth known case of conjoined twinning in a cetacean species.

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